

Accelerator Systems Division Highlights for the Week Ending December 6, 2002

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments this week: (1) Started 96 hour heat run on E2V (Marconi) klystron #6 this week; (2) began high-power acceptance tests of a 402.5 MHz load and two 402.5 MHz RF/vacuum windows; (3) Paul Tallerico was at ORNL to support installation, klystron repair, and review installation and troubleshooting procedures.

Concerns & actions: (1) E2V klystron #6 originally arrived with a shorted coil in the integral focusing magnet - we worked with vendor to disassemble and analyze the magnet in place. With their guidance, we determined the cause of the problem (shrink-tube insulation on bolt had worn through, allowing bolt to touch shielding). We made repair. Tube appears to be fine. (2) 550-kW test stand at Thales failed again, canceling SRF klystron test in December. We informed Thales that our schedule is critical, and we may be forced to reduce the order.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) ORNL HV converter modulator (HVCN) operated in support of the RFQ Klystron testing and evaluation. There was an occasional noise problem with remote EPICS operation, so the modulator was operated in local mode.

Concerns & Actions: (1) Late on 12/6 near the conclusion of operations, the one phase of IGBTs on the ORNL HVCN failed during 100-kV operation. Cause of the fault is being determined. LANL personnel will gather test equipment and spares, and will take them to ORNL on Sunday to help with troubleshooting and repair. (2) During running of the LANL prototype modulator for the E2V klystron heat test, the modulator began showing large amounts of output ripple. The test was interrupted to diagnose problem. Output filter choke was found shorted due to improper routing of the leads after the last work on the HVCN. Leads were re-routed, and HVCN is being reinstalled, and should be ready for operation on Monday. The model of the modulator electrical circuit showed this exact effect when choke is shorted. (3) LANL personnel were at Dynapower to conduct QA reviews and support manufacturing of the production HVCNs; (4) Late on 12/6, the 13-kV AC substation switchgear at LANSCE feeding the LANL HVCN failed upon re-energizing following breaker maintenance. The HVCN system was disconnected when this failure occurred, avoiding further damage. The cause and impact of the problem is being assessed.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Coronado Machining started rebuilding approximately 20 tank-1 drift tubes. Rough-machined, shrunk-fit hardware is shown in Fig. 1; (2) approximately 200 drawings for the tank-3 drift tube repairs were generated; (3) a baseline schedule was established; (4) LANSCE-1 Mechanical Engineering group stated work in support of the drive iris, EDM drift tube, and BPM drift tube manufacturing; (5) personnel were identified from LANL ESA and DX division for transfer into SNS; (6) we hosted a comprehensive 3-day external review of the DTL design and manufacturing plan; (7) a contract for the tank-2 water manifold was awarded to AVANTech.

Concern & actions: (1) We need experienced mechanical engineers and designers to execute the DTL manufacturing plan. A full request has been developed and we are working with other LANL directorates to facilitate transfers.

COUPLED-CAVITY LINAC (WBS 1.4.4)

Accomplishment: A contract was awarded for the vacuum manifold to Kurt J. Lesker Co.

LINAC PHYSICS (WBS 1.4.5)

Accomplishments: (1). The diagnostic plate (Fig. 2) successfully completed vacuum tests and was shipped to ORNL.



Fig. 1: Rough machining of new DTL Tank 1 drift tubes



Fig. 2: DTL-1 Diagnostic Plate

ASD/JLAB: Cold Linac

ASD/BNL: Ring

R. Lambiase and J. Sandberg are at IE Power this week. The purpose of the trip is to inspect the first article medium range power supply and participate in a design review of the Ring dipole power supply. IE Power has both production contracts.

A videoconference was held with ASD to discuss open issues related to the Ring half-cell assembly and BNL's planned delivery schedule.

Discussions are underway between ASD's M. Hechler and BNL's H. Hseuh on deliveries of remaining HEBT vacuum equipment, needed to support ASD's installation efforts.

Our magnet assembly spreadsheet has been revised to reflect the complete sorting of dipoles provided by the BNL/SNS AP Group.

The SNS/Mechanical Group conducted an internal design review covering the ring injection region. Specific areas of review included the vacuum chambers, lattice check, dump septum, design of chicane magnets #1, #2 and #3, injection dump/thick foil design, field quality of chicane #4, and status of the magnet stands.

Technical Issues Forum on Electron Cloud has been rescheduled for Tuesday, Dec. 17th, at 2 PM. Jie Wei will present a global view to ASD management.

A second revision to the Controls/Collimation ICD is being circulated internally for review and comments. Kathy Brown is preparing the paperwork for submittal to DCC.

A call has been made for PAC'03 papers. To date, thirty-five abstracts have been received.

A PCR for Ring vacuum spares has been submitted for approval.

A PCR is being prepared to transfer scope and budget for the residual gas analyzers. This effort will be transferred from BNL to SNS/OR.

Carbon Wire Scanner – a beam box design is underway to accept LANL's 5.78" wide fork and to accommodate the laser wire set-up for the HEBT wire scanner. In addition, finished a design study that puts the carbon wire and laser wire in separate chambers.

Dipole measurements are done. This test station will be converted for use in measuring the production quads (26Q and 30Q).

Seven of the 27CDM30 (28) correctors have been measured. Number eight is being set-up today.

Chicane #4 – measurements have begun and preliminary analysis of short coil and long coil field data is underway. Initial results suggest the need of a "z" bump on the ends of the pole piece.

Tesla is preparing their last six (Ph. I) Production magnets for shipment to BNL next week. Phase II delivery should begin in January.

BINP reported receipt of BNL supplied material. Work is progressing on their production tooling.

Assembly work continues on power amplifier #2 for the Ring RF.

Support pedestals for the HEBT 12Q45 quadrupole magnets are being prepared for shipment to SNS/OR.

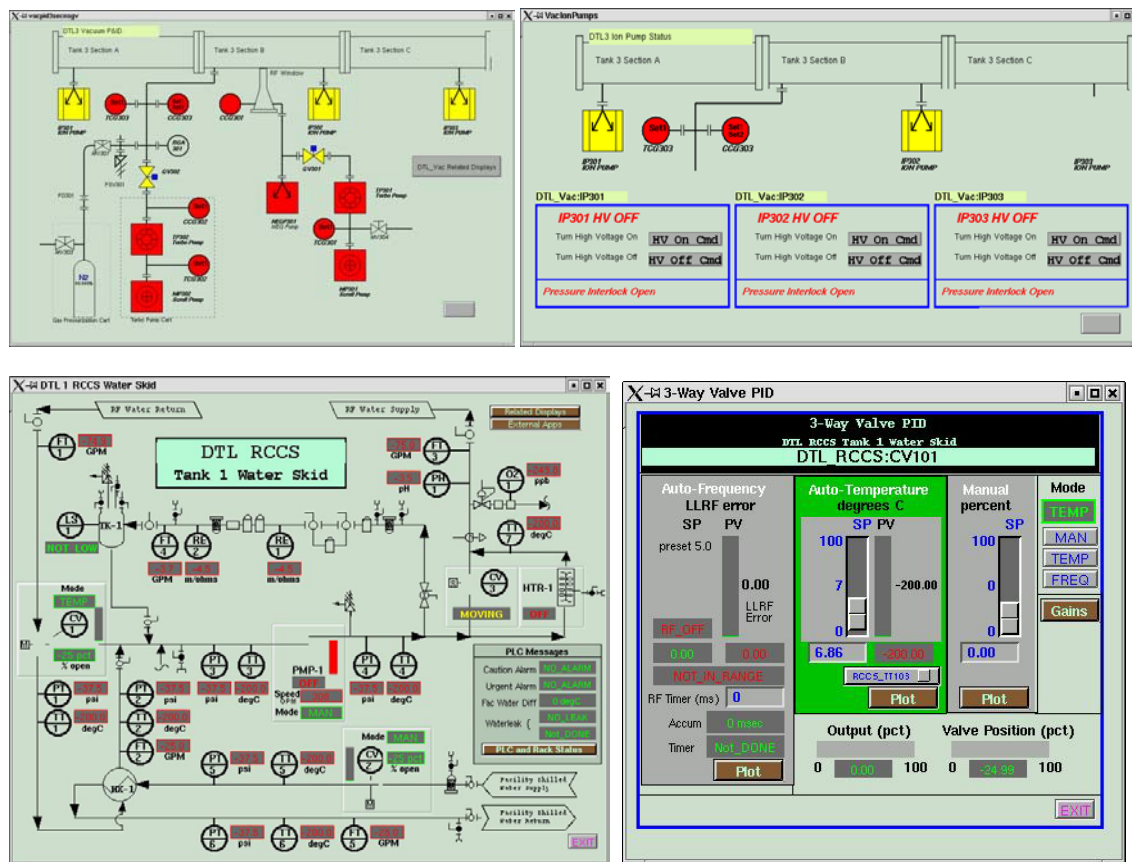
Controls

Studies and measurements proceeded on the EMI issues at the site. A working group was formed to address this issue, and an initial measurement and mitigation strategy was developed. At the end of the week, performance seemed somewhat improved, with no timing system loss-of-synch errors observed with the RF system running at 100kV. Ion Source sparks are also an observed interference, however. Mike Thuot of LANL will visit next week to consult on this issue.

A minimum set of MPS signals required for initial beam operation into the MEBT was agreed with Operations, and considerable progress was made in the field towards wiring and testing these inputs. A first attempt at certifying the PPS system for MEBT operation encountered some difficulties with RF power supply interfaces. The procedure has been modified, and the process will resume next week.

Six team members from LANL visited ORNL this week. Software and documentation for the RCCS and Vacuum systems was reviewed. The initial release of DTL vacuum and RCCS control software has been installed on the SNS

operational server. Both DTL vacuum and RCCS IOC's (dtl-vac-ioc1 and dtl-rccs-ioc1) are configured and up running. Here are some live screen shots.



At LANL, the SCL/QMCS drawings are complete and submitted. The Power Supply test rack is as complete as possible. Database changes were prepared to reflect HPRF PLC changes; engineering unit conversions and fault chatter were added. The study of VDCT, a new database configuration tool, was completed. This tool is now deemed to be usable, and will be the tool of choice for SNS applications.

At BNL the Beam Current Monitor Labview application user interface was redesigned to increase throughput and simplify layout. With the redesign, all new BCM features, including automatic calibration can be performed at 6 Hz.

The specification for the CF Controls Process Waste Monitor (activity monitors that detect radiation in condensate and other water sources from the tunnels) was issued CFC.

Installation

Craft Snapshot 11/20/02

ASD craft workers	58.0
Foremen, ES&H, etc	9.5
Less Wbs 1.9 controls	-6.0
Less absent	-1.0
TOTAL	60.5

Accelerator Physics

Over the last several months the ORBIT code capabilities have been enhanced with the addition of thin-lens elements and alignment and strength errors. The errors and thin-lens elements have been benchmarked. The last remaining piece is the addition of hard-edge fringe-fields, which is nearly complete.

E. Tanke, A. Aleksandrov and J. Galambos are participating in the SNS Shielding Review with the Radiation Safety Committee.

The ORNL AP group submitted 16 abstracts to the PAC 2003 conference.

AP group members are working with the mechanical group to finalize scrapers, apertures and diagnostics desires for the front-end anti-chopper box.

Operations Group

Mario has been giving LOTO training to all groups in the division following the LOTO incident.

Operator Training continues

We are preparing responses to the ARR Committee "to do" list for DTL-3 e.g. - Radiation Shielding Review Friday, maintenance plan,

CLO - Lab Space was discussed

Creating the management plan for the maintenance system

Certification procedures are complete for Version 0.0. We hope to do the entire PPS certification including the RFQ Rebuncher supplies this week.

Ion Source Group

With Dave Brown becoming a certified ion source operator, the ion source training has been completed. His training included a cesiation as the ion beam current initially fell below 1 mA/kW.

During the training, a discharge led to a completely unmatched source. It was found that an arc in the matching network destroyed the outer plastic shield of the coaxial cable of the antenna current monitor and therefore it shorted to the tunable capacitor. The cable was replaced and covered with a plastic tube to increase its standoff voltage.

The area where the cooling water lines enter the matching network from the blue box remains a concern. A PVC tube was previously install to reduce the likelihood for discharges towards ground. However, discharges have blackened the tube and it appears that some of the material was deposited on the insulator. The insulator was cleaned and the plastic tube was removed.

Mechanical Group

Magnet Systems

Vacuum Systems

Linac HPRF

E2V Klystrons 1 & 2 were repaired on the 5th. The tube in the RFQ slot produced 1 MW of RF with no waveguide arcing. After the water leak fix, by Don Richied's people, the tube in the DTL 1 slot, shows no signs of leaking.

RFQ klystron connected to RFQ structure, safety sign off is in progress, last minute preparations being made, low power into RFQ as soon as possible, calibration checks of power readings to follow, serious conditioning to begin today and continue.

The HVCM lost an IGBT module and sundry associated components this evening. Dave Anderson is sending out a report. We probably won't be able to run until next Tuesday the earliest (waiting for parts from Los Alamos). I revised the last sentence of the previously sent weekly report.

Expert pipefitters repaired an internal water leak in the DTL-1 402.5 MHz 2.5 MW klystron serial #2 from the SNS cryogenic group. The repaired fitting was tested under full pressure for 0.5 hr with no leaking.

Arcing in the RFQ klystron was traced to a cracked spacer ring at the transition between the output coax center conductor and the T-Bar waveguide transition. The E2V factory representative replaced the ring. Initial evaluation suggests that the knife-edge retainers were over-tightened at the factory. The klystron was run up to 1MW RF power with no arcing indicating the fix was good. The protective waveguide short was unlocked and removed between the RFQ klystron and the RFQ, in preparation for conditioning of the RFQ.

Ran the HVCM past few days at 100 kV, 60 Hz, while waiting for klystron repairs. Verified PPS operation and ran as a "noise source" to allow for debugging of the timing system faults. Turned the voltage up to 110 kV tonight for approximately 1 minute before we blew up an IGBT on C phase. We removed the failed switch plate assembly for further inspection, and noticed at least one IGBT destroyed as well as some support electronics. Since we have no spare IGBTs available at ORNL, we did not attempt repair. LANL is sending some support on Sunday, along with spare parts for repair. We'll take some additional measurements on Monday to try and determine the cause of the fault.

Linac LLRF

ORNL

The RFQ Low Level RF control system is ready to support RFQ conditioning.

Kay Kasemir was at ORNL this week. Kay implemented and tested the HPM consecutive fault feature, which will latch the RF inhibit in the case of multiple faults. The HPM EPICS screens were modified to provide a more friendly user interface.

Karl Lionberger cleaned up some of the Front End EPICS screens to more accurately reflect the Oak Ridge installation. The RFQ conditioning program was examined and modified; the means for adjusting the RF drive level is different at Oak Ridge compared to at Berkeley.

The Rebuncher cavity vacuum interlocks to the RF control system were confirmed to be properly configured.

One of the Rebuncher Low Level RF control chassis is being investigated on the bench at RATS. There appears to be a signal level problem. The cause will be determined and an appropriate repair implemented.

The management team (Champion, Ratti, Shoaee) met with the LLRF Advisory Board on Thursday to inform the Board of the state of the project.

There will be a system-modeling meeting at LBNL on Dec. 12. Sung-il Kwon will explain his Matlab models to Larry Doolittle, Stefano DeSantis, Greg Portman, and Sang-ho Kim. There will be discussion on how to combine the Matlab models and FPGA code simulations to perform an integrated system simulation of the LLRF control system prior to prototyping and bench testing.

The Initial Design Review for the Field Control Module will be held at Los Alamos on Dec. 17. Curt Hovator, Chris Ziomek and Larry Doolittle have been asked to serve as the reviewers. Most (if not all) members of the LLRF Advisory Board will attend.

There will be a Code Development meeting at Los Alamos on Dec. 18. This is somewhat analogous to the hardware brainstorming meeting that was held at LBNL on Oct. 25. We plan to map out a detailed strategy for designing, developing and testing the IOC and FPGA code.

Orders were placed for the following software tools, that will be used to support the detailed design of the FCM:
 Xilinx embedded development kit (for MicroBlaze 32-bit soft processor).
 MentorGraphics design capture software.
 Denali Memory Modeler

Craig Swanson has been working with the LBNL codes to confirm the portability of these codes.

Electrical Systems Group

Survey and Alignment Group

Cryogenics Group

We have beneficial occupancy of the CHL and the RF buildings.

The Linde/Boc technical team is here to complete the installation of the 4.5K cold box. The shipping braces have been removed and leak testing is under way.

Tunnel: Installation continues on the east and west supply end boxes.

Transfer lines: The return west end box is completed and ready for shipping.

Cryomodules: We have started leak testing the insulating vacuum of the prototype medium beta Cryomodule.

Beam Diagnostics

ORNL beam diagnostics report:

Laser profile monitor design is progressing very well. We are in the QA phase of the laser and the optics prior to the MEBT tests. We have had more than 1/2 million pulses on the laser under the controlled conditions. Two experiments were performed to assure us on optics/vacuum window integrity. The first test of >200000 pulses with 4 times the laser beam power on the fused silica window went very well. There is no indication of laser beam heating or damage to the window. We decreased the laser spot size by a factor of >12 from the operational requirement; that means the incident peak power on the window increased by 25-30 from the operational condition. After 250000 pulses, there was not any observable damage. Warren Grice and Jim Pogge will extend the above tests with more intense (focused) laser beam on the next controlled setup being proposed by the diagnostic/controls and the ME groups. Peter Ladd (lead ORNL vacuum expert) and Johnny Tang (SNS-Controls) will setup an RGA with the prototype SCL laser box under vacuum to test the laser interaction with the fused silica windows to monitor any impurities liberated next week. This QA is required prior to writing the window cleaning procedure for the JLAB.

Dave Purcell is working on the Laser profile imaging. His system is fully operational (Fig-1) and can be used to display the Laser spot (Fig-2a, b), take cross sections (Fig-3), calculate the RMS width and much more. The following few pictures show some of Dave's analysis of Warren's measurements.

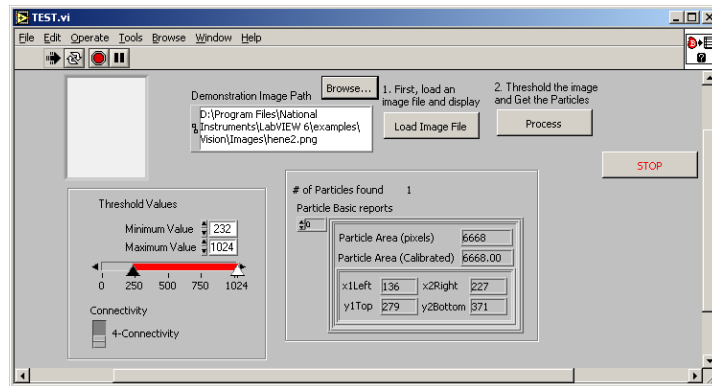


Fig-1). Image Analysis Application.

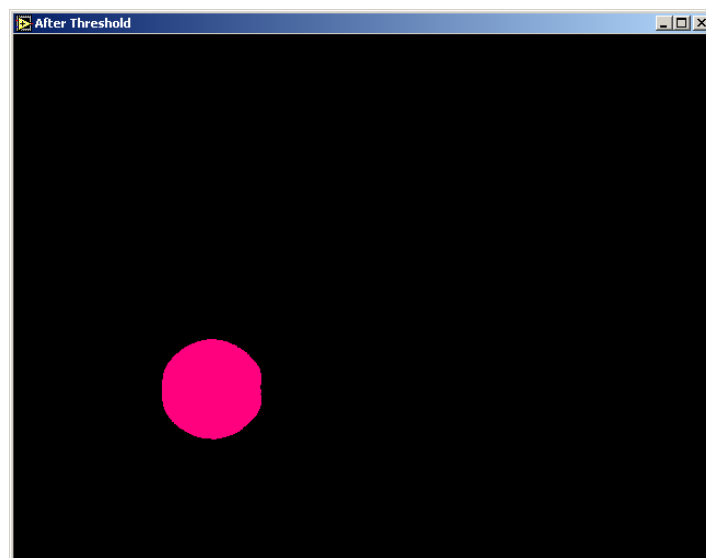


Fig-2a) Captured Laser-beam spot prior to analysis.

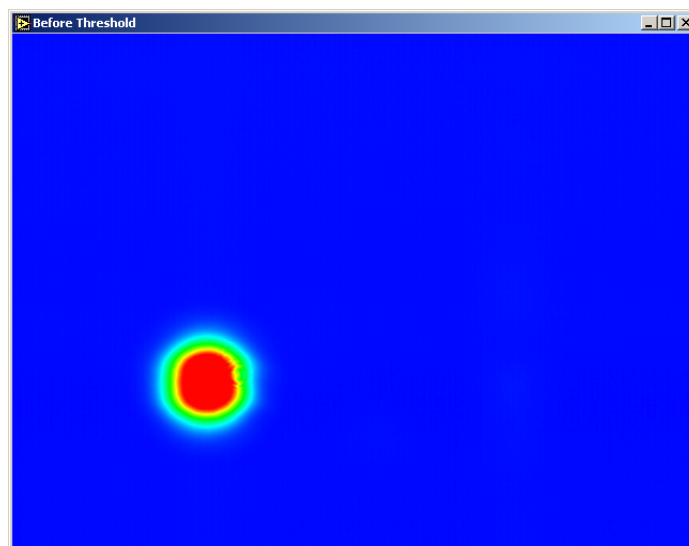


Fig-2b) False colored is assigned to the Gaussian laser-beam spot.

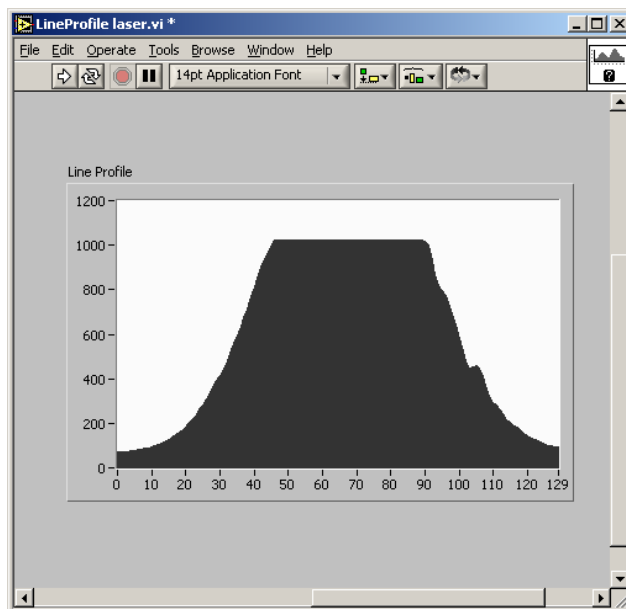


Fig-3) Magnified Laser cross section (Saturated center).

Wim and Matthew are working on the Laser-wire DAQ. We have offered to adapt the same software for the proposed MEBT pinhole actuator by the AP group. The same can be applied to the MEBT viewing screen.

We are preparing for the D-plate arrival. Ernest and Delphy are working on the MEBT emittance system. We have also started noise measurement and integration of the MEBT diagnostics with MPS system.

BNL beam diagnostics report:

General: Group members are preparing presentations for Tom Shea's visit next week.

1.5.7.1 BPM: The final five 26cm BPMs were received back from brazing. Baseband AFE layout continues. Parts orders are being placed. Schematic for breakout board for BPM IFE testing was prepared and is in layout. Engineering design of prototype RF AFE is complete, component selection is in progress.

1.5.7.2 IPM: Detailed design of detector and vacuum chamber continues. What appears to be a good solution to the problem of calibration of the IPM during aging and depletion has been found. The IPM will have a Burle Electrode Electron Generator array as a calibration source. This is a microchannel plate in which the input channels are doped for greatly decreased work function. A modest bias voltage causes the MCP to emit a very uniform cold electron beam, which uniformly illuminates the detector MCP. This will give us the capability to monitor MCP aging accurately with no moving parts. Electromagnets for the IPM have been designed, and a detailed cost estimate has been completed.

1.5.7.3 BLM: Layout for PCB for the eight channel AFE module is nearing completion. Design of testing fixture for the AFE is underway. An order has been placed for 15 end-cap RC network PCBs. Confirmed delivery of 10 LND (new ION chamber design) in mid January email discussions are underway with A. Feschenko regarding neutron detector design and integration.

1.5.7.4 BCM: Work is proceeding on evaluating software changes. Fabricating transformer insulator rings for the prototype HEBT BCM.

1.5.7.5 Tune: Detailed design of kickers is proceeding, specification for custom high-voltage feedthroughs is being written.

1.5.7.6a Carbon Wire Scanner: Reviewing and correcting newly updated drawings for the MEBT wire scanner. Designing a beam box to accept LANL's 5.78" wide fork and to accommodate the laser wire set-up for the HEBT wire scanner. Obtained a quote for this design. Finished a second beam box design, which puts the carbon wire and laser wire in separate chambers. This design is currently under review.

1.5.7.6b Laser Wire Scanner: Preparations for testing at 750KeV continue

LANL beam diagnostics report:

BPM pickups: One SCL BPM has been mapped and tested for electrode contact pressure. After the TDR and network analyzer tests are complete it will be shipped to ORNL. We are on schedule for a mid-December delivery.

BPM electronics: At Bergoz instrumentation, 2 ea. second-generation analog front ends (AFEs) have been assembled, and they are waiting for parts needed to assemble the rest. We hope to receive the first shipment before Christmas. The modifications to the digital front end (DFE) card are waiting for ECAD. Work is in progress in ECAD on the next-generation PCI motherboard. This card will have a small daughter card that will contain the new clock circuit layout. This daughter card will simplify any future design changes and allow us to more easily respond to changes that may be required by the on-going re-design of the 2.5-MHz distribution system at ORNL.

WS actuators: Wiring is complete on one WS actuator needed for DTL-1 and the D-plate, and almost complete on the other. Work continues to finalize the design of the HEBT beam box with BNL. We now have a draft Statement of Work that, when complete, will be used to control the fabrication of the remainder of the actuators at Huntington.

WS electronics: We are waiting for ECAD resources to complete the design modifications on the PC board needed for the DTL-1 and D-plate electronics. About 70% of the parts needed to stuff these boards are now on hand.

ED/FC actuators: Fabrication is almost complete on the two units needed for DTL-1 and the D-plate. We just need some nickel plating done on the D-plate unit, and both units need 24-V solenoids.

ED/FC electronics: Fabrication continues on the DTL-1 and D-plate unit.

D-plate: The D-plate was shipped to ORNL on 3/Dec. It is expected to arrive 9/Dec. Work continues on the emittance gear actuators, the halo scraper / beam stop electronics (that are functionally very similar to the ED/FC electronics), and documentation.

Misc: We've received the RTDL/event link PCI card from ORNL. Software work for this board will commence soon. We are working to add remote access capability to the LANL shared memory DLL.